



SERIES MTB-10 MAGNETIC TAPE BUFFER SYSTEMS

INTRODUCTION

Nuclear investigations involving three, four or even five parameters have become increasingly common in recent years. Normally, resolution requirements have imposed limitations on the use of traditional multi-channel analyzer techniques in such applications.

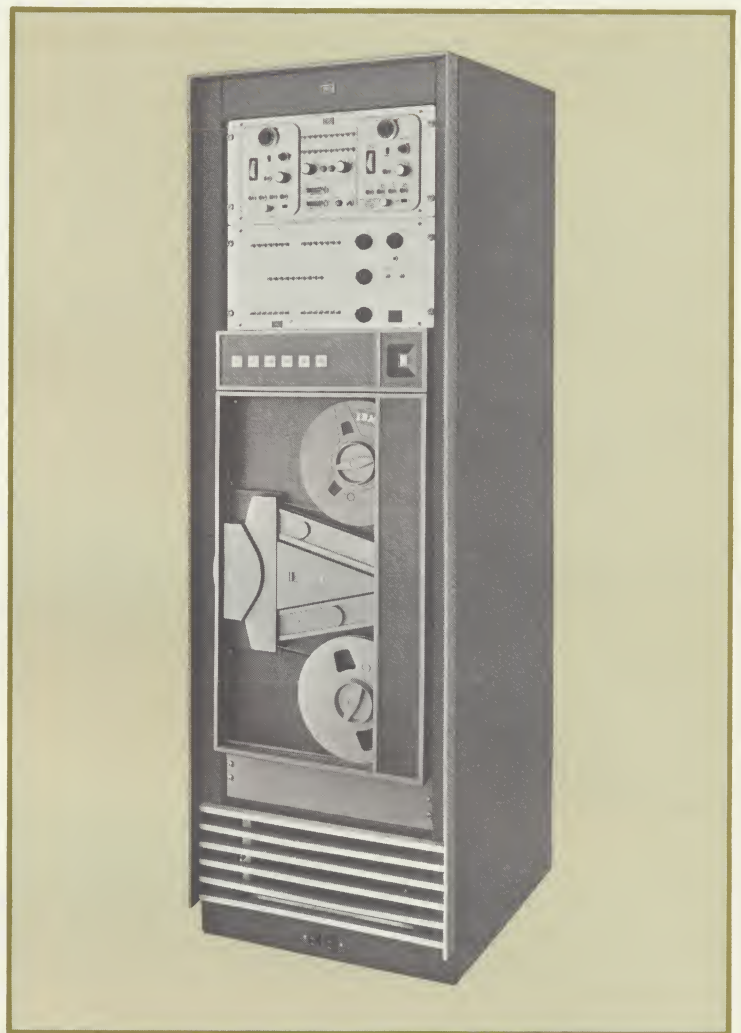
In order to store data from multiple sources in an analyzer's memory, the memory must be divided into separate groups, and as the number of groups increases, the resolution available within each group decreases proportionally. By limiting the information recorded in the memory to selected portions of the total multi-parameter field, sufficient resolution can generally be obtained. However, this method frequently requires that the experiment be repeated to obtain data from other parts of the field.

DESIGN CONCEPT

Technical Measurement Corporation's MTB-10 System was developed to permit analysis of up to ten simultaneous inputs without sacrificing either resolution or size of field. This is accomplished by transferring input data from as many as ten digital sources (analog-to-digital converters, scalars, clocks, etc. in any combination) into computer-compatible format on 1/2-inch magnetic tape.

Information can be read into and out of the system at the same time, at a rate of approximately 16,680 characters per second in each direction. Included in the system are a 1024 x 14 bit buffer memory, internal parity generating circuits, and provisions for playback of magnetic tapes into a multi-parameter analyzer.

When used with one or more TMC Model 217A/242A Two-Parameter Input Units, the MTB-10 System provides storage resolution of one part in 4096 for each input signal. This high resolution, combined with high speed and virtually unlimited storage capacity, makes the MTB-10 System particularly suitable for applications where data must be buffered before transfer to a general-purpose computer.



COMPLETE DATA RETENTION

In addition to extending the number of parameters which can be processed by a multi-channel analyzer, the MTB-10 System also assures total retention of data to minimize the risk of having to repeat a difficult experiment. The system will operate independently from, or in conjunction with, an associated pulse height analyzer; this permits real-time processing of selected inputs by the analyzer while more complete information is stored on tape for subsequent data reduction.

All MTB-10 Systems are designed for ultimate expansion to ten inputs. Starting with a basic two-input or four-input system, the user can increase the capacity of his system as required by simply adding new analog-to-digital converters and Model 242A Two-Parameter Input Units.

TECHNICAL MEASUREMENT CORPORATION

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SYSTEM DESCRIPTION

GENERAL

The basic elements of an MTB-10 System are:

- (1) One analog-to-digital converter or other digital information source for each input. For pulse height analysis, analog-to-digital conversion is normally performed by a TMC Model 217A Pulse Height Logic Unit. In other applications, a Model 204 Spectrum Multiscaler Logic Unit, Model 211A Time-of-Flight Logic Unit or other source of digital information may be used.
- (2) One Model 242A Two-Parameter Input Unit for every two inputs.
- (3) A Model 526 Magnetic Tape Buffer Unit.
- (4) A Datamec Model D2020 Magnetic Tape Transport. (Transports can be supplied for tape speeds of 15 or 30 inches per second and for packing densities of 200 or 556 bits per inch.)
- (5) A Model 527 Playback Unit. (This unit is required only for applications where data is to be played back to a multi-channel analyzer system.)

PRINCIPLE OF OPERATION

Inputs from the analog-to-digital converters are connected to the input registers of the Model 526 Magnetic Tape Buffer Unit through parallel address registers in the Model 242A Two-Parameter Input Units. When a pulse height-to-time conversion, for example, is completed in any one of the ADC units, digital information will be held in the parallel address registers of the Model 242A until the Model 526 receives a "ready" pulse from the ADC associated with each parameter in use.

When all input units have presented a "ready" signal, a scanning cycle is initiated by the control circuitry in the Model 526. Information is then transferred sequentially from each ADC to the Model 526 input registers in the form of two 6-bit characters.

The Magnetic Tape Buffer Unit adds a parity bit to each input character and stores the resulting 7-bit characters in the buffer memory. After information is transferred from all input registers in use, the input gates of the analog-to-digital converters are opened to accept new information.

The buffer memory operates independently from any associated multi-parameter pulse analyzer. This independence allows parallel, selective analysis of original data to be performed by the analyzer. The Magnetic Tape Buffer System may also be used to free the analyzer for use in unrelated experiments while data is being accumulated in the buffer memory.

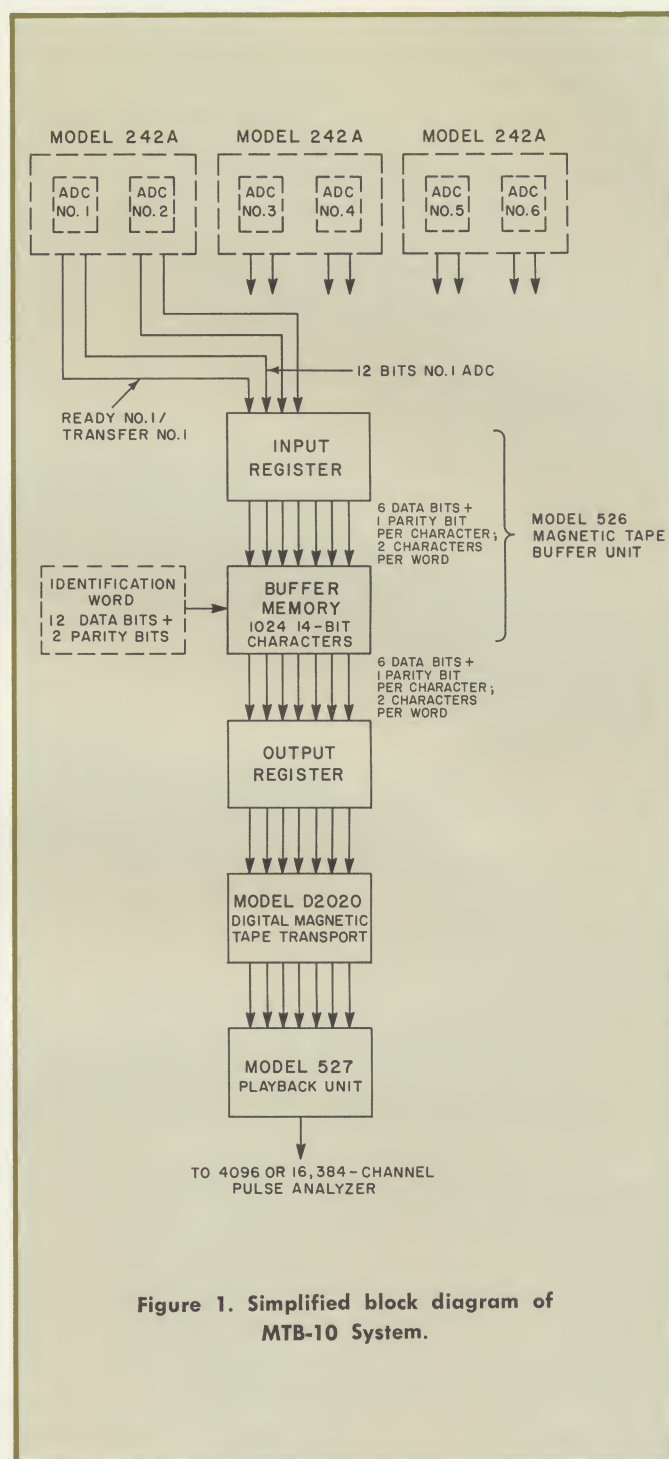


Figure 1. Simplified block diagram of MTB-10 System.

In the playback mode, data recorded on magnetic tape is accepted by the Model 527 Playback Unit and assembled into the required format for playback to a TMC CN-1024, 4096-channel or 16,384-channel analyzer system. Front-panel controls on the Model 527 permit selection of the number of inputs to be entered into the memory of the analyzer.

PRINCIPLE OF OPERATION (Continued)

To read the results of an experiment into a pulse height analyzer, the output of the Model 527 Playback Unit is routed first into either a Model 244A or Model 248 Format Selector, then to the memory of the analyzer. A maximum of eight parameters may be analyzed on playback with a Model 248, or a maximum of four parameters with a Model 244A. Restriction gates may be applied to the transferred data, if necessary, in order to limit the data stored in the analyzer's memory to specific areas of interest in a single-parameter or two-parameter spectrum.

MEMORY CAPACITY

The total capacity of the buffer memory is 2048 7-bit characters in a 1024 x 14 bit configuration. The Model 526 Magnetic Tape Buffer Unit will accept data from associated ADC units until its memory is filled, then transfer information onto magnetic tape at a rate of approximately 16,680 characters per second. The ultimate memory capacity of the system is therefore determined by the packing density and length of the magnetic tape, rather than by the Model 526.

One of the most significant features of the Model 526 is its ability to accept data continuously while in the transfer mode. Consequently, no dead time is required for memory dumping.

DATA FORMAT

Data is recorded on the magnetic tape in standard IBM binary code (illustrated in Figure 4 for a four-input application). Transverse and longitudinal check characters and proper interfile gaps for computer compatibility are automatically added as data is processed by the MTB-10 System.

FILE IDENTIFICATION AND SEARCH

Provisions are made in the Model 526 for manual insertion of identification words and end-of-file marks into the magnetic tape record. Each identification word consists of two 6-bit characters with appropriate parity, as selected by front-panel toggle switches.

When data is played back from the tape, the Model 527 can be used to select an identification word for automatic search purposes. When the selected word is located, data in the corresponding file will be played back into the system memory. The tape transport will then stop at the end of the selected file.

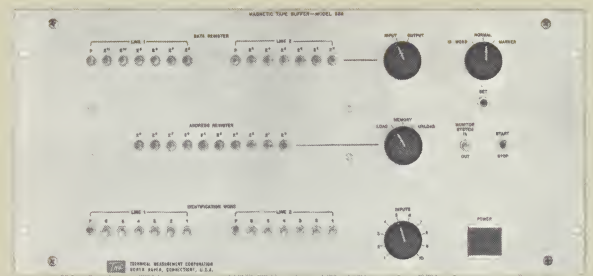


Figure 2. Model 526 Magnetic Tape Buffer Unit.

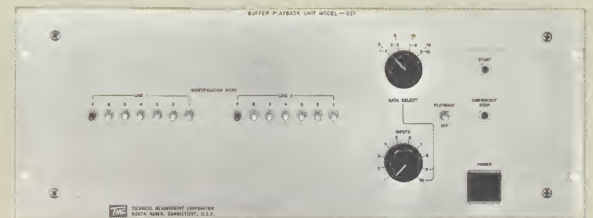


Figure 3. Model 527 Buffer Playback Unit.

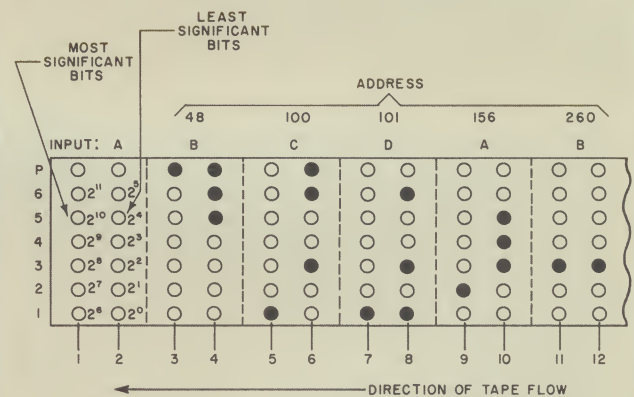


Figure 4. Typical Tape Word Format for Four-Input Tape. Note: parity bit will be entered if either most or least significant column is not utilized.



SERIES MTB-10 SPECIFICATIONS

MODEL 526 MAGNETIC TAPE BUFFER UNIT

INPUTS

Number of Inputs: Up to 10 words of digital information presented in parallel. The number of words in use is switch-selectable by means of a front-panel control.

Input Format: Binary.

Maximum Word Length: 12 bits.

Input Data Rate

One word (12 bits) : approximately 8000 per second.

Two words (24 bits) : approximately 4000 per second.

Four words (48 bits) : approximately 2000 per second.

(Based on 30 ips, 556 characters per inch tape transport and excluding record gaps.)

INPUT REGISTER

Capacity: 14 bits. Accepts a maximum of 12 bits of data in parallel from the input scanner and two bits from internal parity generators.

Grouping: Input words are divided into two parts, each containing a maximum of six data bits plus one parity bit. Parity is entered automatically.

MEMORY

Type: Parallel access, ferrite cores.

Capacity: 1024 x 14, divided into 2048 locations of seven bits each. Therefore, each location corresponds to one character (six bits plus parity) as recorded on tape.

RECORDING SPEED

15 or 30 inches per second, as specified by user. Dual-speed transports (15 and 30 inches per second) optional.

PACKING DENSITY

200 or 556 characters per inch, as specified by user. Dual-density transports (200 and 556 characters per inch) optional.

DATA FORMAT

IBM binary code.

TAPE CAPACITY

2400 feet. Approximately 6672 characters per foot or 16×10^6 characters per roll of tape at 556 bpi packing density. Approximately 2400 characters per foot or

Memory Cycle Time: Less than 15 microseconds for a 14-bit word.

OUTPUT REGISTER

Output Format: Binary, seven-level (six bits plus parity).

Maximum Transfer Rate: 16,680 characters per second, or 112,000 bits per second from buffer memory to magnetic tape transport with 30 ips speed and 556 bpi packing density.

File Identification: Identification word consisting of two six-bit characters plus appropriate parity may be manually entered. Selectable by front-panel switches.

End of File Mark: Manual entry, two characters. All bits are one.

Record Length: 1024 characters. Output register is automatically programmed to coincide with the number of inputs selected.

POWER REQUIREMENTS

60 watts operating power at 110 volts, 60 Hz or 230 volts, 50 Hz.

DIMENSIONS

19 in. W x $8\frac{3}{4}$ in. H x 19 in. D.

WEIGHT

Approximately 50 pounds.

MODEL D2020 MAGNETIC TAPE TRANSPORT

5.76×10^6 characters per roll of tape at 200 bpi packing density.

POWER REQUIREMENTS

Approximately 600 watts standby, 750 watts average operating power at 105 to 126 volts, 58 to 62 Hz.

DIMENSIONS

Transport: 19 in. W x $31\frac{1}{2}$ in. H x 12 in. D behind mounting rail.

Local Control Panel: 19 in. W x $5\frac{1}{4}$ in. H x 9 in. D.

Data Electronics: 19 in. W x $5\frac{1}{4}$ in. H x 16 in. D behind mounting rail.

WEIGHT

Transport: 138 pounds.

Local Control Panel: 20 pounds.

Data Electronics: 35 pounds.

MODEL 527 BUFFER PLAYBACK UNIT

INPUT

One only, from read head of tape transport.

INPUT FORMAT

Parallel by bit (seven-level binary, six data bits plus parity), serial by character.

OUTPUTS

1, 2, 3, 4, 5, 6, 7 or 8 twelve-bit data words in parallel.

Data output terminals on rear panel can be connected to select required words.

OUTPUT FORMAT

Parallel binary, compatible with TMC Model 244A or 248 Input Format Selector.

POWER REQUIREMENTS

200 watts at 110 volts, 60 Hz or 230 volts, 50 Hz.

DIMENSIONS

19 in. W x 7 in. H x 18 in. D.

WEIGHT

Approximately 50 pounds.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE



MODEL 525/D2020 MAGNETIC TAPE SYSTEM

GENERAL DESCRIPTION

The Model 525/D2020 is a versatile magnetic tape system with special interface provisions for operation with a TMC 4096- or 16,384-channel pulse analyzer system. In addition to its primary function — high-speed recording of experimental data for reduction by a general-purpose computer — the system also contains provisions for playback to the analyzer system.

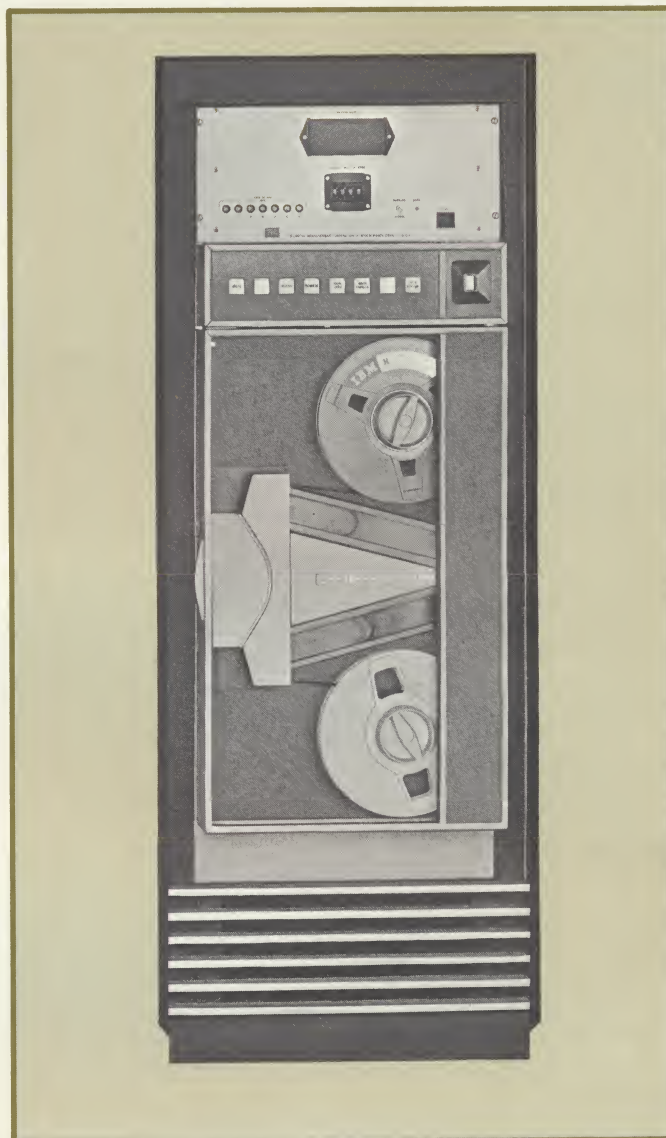
All system control and interface circuitry are designed and manufactured by Technical Measurement Corporation. The tape transport, local control panel and tape data electronics panel are standard Datamec units designed to comply with IBM specifications. Before shipment to the user, all components are subjected to rigorous TMC quality control procedures and tested on a system basis.

MODEL 525 MAGNETIC TAPE CONTROL UNIT

The Model 525 contains all necessary circuitry for interconnecting a Datamec D2020 tape transport with the Model 437 or 446 control unit of a TMC multi-parameter analyzer. Information from the analyzer is automatically divided into 16 records (for either 4096 or 16,384 channels) with proper interfile, record and longitudinal gaps for IBM compatibility. Front-panel controls on the Model 525 also permit manual insertion of an end-of-file mark onto the tape after completion of a record.

System operating mode (record or playback) is determined by the Model 437 or 446 control unit. In the record mode, a four-digit tag word may be selected at the analyzer control unit for insertion at the beginning of the tape record. In the playback mode, switches on the Model 525 are used to select a tag word for search purposes.

When it receives a playback command from the Model 437 or 446, the 525/D2020 system will scan the tape until the selected tag word is located. An indication of the tag words being scanned is provided by a Nixie tube display. As it scans the tape, the Magnetic Tape Control Unit compares the selected tag word to the contents of a register associated with this Nixie tube display. When the selected word is located, the Model 525 causes the arithmetic information in the following file to be read into the memory of the analyzer system.



D2020 TAPE TRANSPORT

The D2020 is available in a number of optional models to meet specific application requirements. A tape speed of 30 inches per second, with either 5 or 7 recording tracks and a packing density of 200 characters per inch, is standard.

Mounted immediately above the transport is a local control panel with back-lighted pushbuttons for control of the following functions: automatic or local operation, load point positioning, rewind, reverse drive for file removal, and (where applicable) selection of packing density. The panel also contains a back-lighted "write enabled" indicator and a rotary "unit number designator" switch.

TECHNICAL MEASUREMENT CORPORATION

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Model 525 Magnetic Tape Control Unit

SYSTEM SPECIFICATIONS

TAPE SPEED

30 inches per second.

START TIME

Less than 5 milliseconds to reach $\pm 5\%$ of normal speed.

STOP TIME

Less than 1.5 milliseconds.

READOUT SPEED

Less than 25 seconds for 16,384 channels.

Less than 10 seconds for 4096 addresses.

RUN CHARACTERISTICS

Average long-term speed deviation is less than $\pm 1\%$.

REWIND TIME

Approximately 2 minutes for 2400 feet of tape.

LOAD POINT AND END-OF-TAPE SENSING

Photoelectric. Dual-channel photo head and sensing amplifiers supply separate voltage outputs for load point detection and end-of-tape warning when the respective photo-reflective strips on the tape pass under the photo head.

TAPE AND REELS

Tape Width: 0.5 inch (0.498 ± 0.002 inch).

Reel Diameter: 10.5 inches.

Reel Hub: IBM standard, other hubs available on special order.

Tape Capacity: 2400 feet of 1.5 mil tape.

MAGNETIC HEADS

Tracks: 5 or 7, as specified by user.

Track Width: 0.048 inch — write.
0.030 inch — read.

Track Spacing: 0.070 ± 0.0025 inch.

Write-to-Read Head Gap Spacing: 0.300 ± 0.005 inch.

DATA ELECTRONICS

Data electronics are mounted in a separate chassis which contains all read and write amplifiers, control cards and power regulators. Separate read and write cards are provided for each data track.

DATA FORMAT

Computer-compatible; 1-2-4-8 BCD, even parity, 6 BCD digits (characters) per word.

FILE LENGTH

From 0 to 8 identification (tag) words plus 256 data words (in 4096 systems) or 1024 data words (in 16,384 systems) per file.

AUTOMATIC GAP INSERTION

File Gap: 3.4 inches between files.

Longitudinal Gap: 0.0075 inch after last character in file.

TAPE MARK GENERATOR

Selector Switch: Two-position switch with Normal and Mark positions.

Pushbutton: Initiates command to insert marker characters when selector switch is in Mark position.

POWER REQUIREMENTS

Voltage: 105 to 126 volts ac, 58 to 62 Hz, single phase.

Power: 40 watts for Model 525 Control Unit; 600 watts for tape unit and data electronics during standby, 750 watts average operating, 970 watts maximum.

DIMENSIONS

Model 525 Control Unit: 19 inches W x $8\frac{3}{4}$ inches H x 18 inches D.

Model D2020 Tape Transport: 19 inches W x $31\frac{1}{2}$ inches H x 12 inches D behind mounting rail.

Local Control Panel: 19 inches W x $5\frac{1}{4}$ inches H x 9 inches D behind mounting rail.

Data Electronics: 19 inches W x $5\frac{1}{4}$ inches H x 9 inches D.

WEIGHTS (Approximate)

Model 525 Control Unit: 40 pounds.

Model D2020 Tape Transport: 138 pounds.

Local Control Panel: 20 pounds.

Data Electronics: 35 pounds.

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